

Mixed and Behavioral Strategies

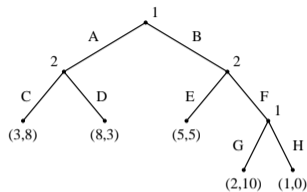
Game Theory Course:
Jackson, Leyton-Brown & Shoham

Randomized Strategies



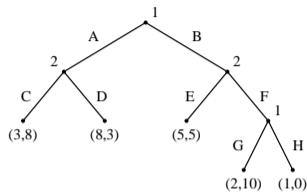
- There are two meaningfully different kinds of randomized strategies in imperfect information extensive form games
 - mixed strategies
 - behavioral strategies
- **Mixed strategy:** randomize over pure strategies
- **Behavioral strategy:** independent coin toss every time an information set is encountered

Randomized strategies example



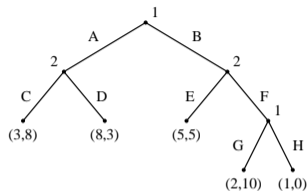
- Example of a behavioral strategy:
 - A with probability $.5$ and G with probability $.3$

Randomized strategies example



- Example of a behavioral strategy:
 - A with probability $.5$ and G with probability $.3$
- Example of a mixed strategy that is not a behavioral strategy:
 - $(.6(A, G), .4(B, H))$ (why not?)

Randomized strategies example



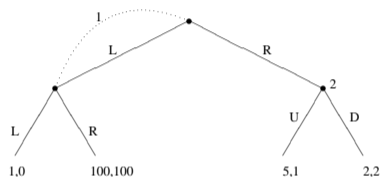
- Example of a behavioral strategy:
 - A with probability $.5$ and G with probability $.3$
- Example of a mixed strategy that is not a behavioral strategy:
 - $(.6(A, G), .4(B, H))$ (why not?)
- In this game every behavioral strategy **corresponds to** a mixed strategy...

Games of imperfect recall

Imagine that player 1 sends two proxies to the game with the same strategies. When one arrives, he doesn't know if the other has arrived before him, or if he's the first one.

Game Theory Online

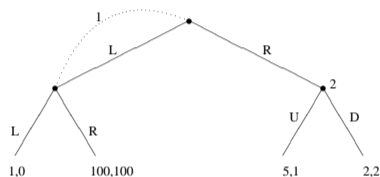
cooperative payoff utility Bayesian Normal-form auctions tragedy of the commons Nash equilibria class players rational strategies zero-sum probability



- What is the space of pure strategies in this game?

Games of imperfect recall

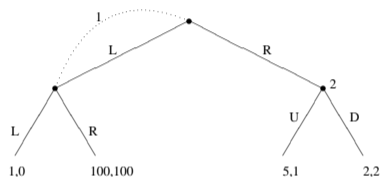
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 - 1: (L, R) ; 2: (U, D)

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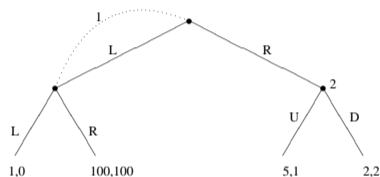


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 - 1: (L, R) ; 2: (U, D)
- What is the mixed strategy equilibrium?



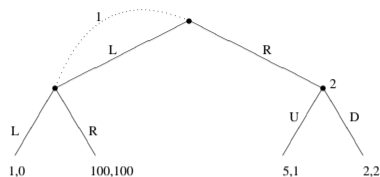
Games of imperfect recall

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- What is the space of pure strategies in this game?
 - 1: (L, R) ; 2: (U, D)
- What is the mixed strategy equilibrium?
 - Observe that D is dominant for 2. R, D is better for 1 than L, D , so R, D is an equilibrium.

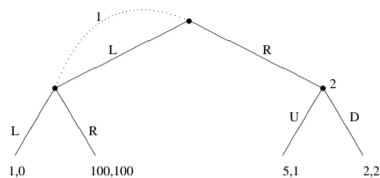
Games of imperfect recall



- What is an equilibrium in behavioral strategies?



Games of imperfect recall



- What is an equilibrium in behavioral strategies?
 - again, D strongly dominant for 2
 - if 1 uses the behavioural strategy $(p, 1 - p)$, his expected utility is $p^2 + 100p(1 - p) + 2(1 - p)$
 - simplifies to $-99p^2 + 98p + 2$
 - maximum at $p = 98/198$
 - thus equilibrium is $(98/198, 100/198), (0, 1)$
- Thus, we can have equilibria in behavioral strategies that are different from equilibria in mixed strategies.